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**Unit 1 Exam Practice Exam Questions**

***Note: I wrote up these questions using our lecture slides from last year. While they are very similar—and often identical—to the ones used this year, some may very slightly (i.e. Dr. Eisenmann taught the cell structure/function lecture this year, while Dr. Cicila did it last year)…so a couple of the questions on here might not have been covered in your lectures. If you find any errors, please let me know. I have also indicated the sections under which you can find the question topics.***

Introduction to Cell Biology

1. Which of the following membrane bound cellular organelles is approximately 0.5-1.0 µm and is important for the utilization of oxygen to provide ATP which drives cellular processes?
   1. Peroxisome
   2. Lysosome
   3. Mitochondria
   4. Smooth Endoplasmic Reticulum
2. In the process of detoxification of a potent drug, part of a liver cells smooth endoplasmic reticulum is damaged beyond repair. In order to recycle the components of this organelle the liver cell will undergo
   1. Autophagy
   2. Endocytosis
   3. Receptor-Mediated Endocytosis
   4. Vesicular Transport
3. During apoptosis after the cell’s DNA has become pyknotic and the cells has started to form blebs what happens to these blebs?
   1. Nothing these blebs remain in the extracellular matrix
   2. The blebs are recognized and cleared away by macrophages
   3. The surrounding cells take up the blebs to degrade them
   4. The blebs coalesce to reform a functional cell
   5. B&C

Proteins

1. The strongest type of bond that exists between two atoms within one or more molecules is
   1. Hydrogen Bond
   2. Covalent Bonds
   3. Electrostatic Bonds
   4. Van Der Waals Bonds
2. You are making salad dressing using white balsamic vinegar (water based) and olive oil when you notice that after letting the dressing sit after mixing it begins to separate into two layers. Which statement best describes this phenomenon?
   1. The electrostatic charged molecules within the two ingredients separate into two layers with one being more positive and one being more negative
   2. The two layers are created because of the separation of proteins from fat
   3. The two layers separate because the hydrophobic fatty acid molecules found in the olive oil try to coalesce together to form larger fatty acid globules by the hydrophobic effect to free water molecules to increase the available amount of free energy
   4. The two layers separate because the water molecules utilize the hydrophilic effect to interact with molecules within the oil layer of the mixture
3. An Emergency Medical Technician arrives to a scene where a 40 year old man is seen to be seated and slouched over. The man’s breathing is extremely fast and shallow (hyperventilating). In order to slow and deepen the man’s breathing down the EMT recommends breathing into a paper bag. What is the basis for this suggestion by the EMT?
   1. This will provide the man with less oxygen and will cause him to pass out which will bring his breathing back to normal.
   2. This will cause the man to increase the amount of CO2 within his blood helping to lower increase its pH and bring it back within normal ranges.
   3. Breathing into a bag will help increase the amount of CO2 diffusing into the blood resulting in more carbonic acid production which will help bring blood pH back to about 7.4
   4. Breathing into the bag will cause more CO2 to be exhaled by the lungs further increasing the pH of the blood
4. Insulin is first synthesized as one polypeptide. It is then processed by cleavage to yield the insulin molecule which is composed of two chains of amino acids covalently linked together, but can be broken up by 2-mercapotethanol. What amino acid could be responsible for this covalent linkage?
   1. Alanine
   2. Proline
   3. Lysine
   4. Cysteine
5. A protein has been isolated and purified. By using Edman Degradation it was found that this protein was 30 amino acids long. What is the approximate Molecular weight of this protein?
   1. 300 daltons
   2. 3300 daltons
   3. 3000 daltons
   4. 150 daltons
6. Two proteins were examined and although they had similar primary amino acid sequences they had greatly differing secondary structures. What factors contribute to these differences in secondary structure?
   1. Amino Acid sequence
   2. ψ and ϕ angles
   3. rigidity of the peptide bond
   4. A, B, & C
   5. B & C
7. A transmembrane protein is composed of one subunit with three domains. These three domains consist of an internal domain for an ion pore, a domain that is responsible for traversing the membrane, and a ligand binding domain. What can be deduced about the pore domain and the domain traversing the membrane?
   1. The pore domain most likely contains charged or polar amino acids
   2. The membrane traversing domain contains mostly hydrophobic amino acids
   3. The pore domain and membrane traversing domain have about the same proportions of hydrophilic and hydrophobic amino acids
   4. The pore and membrane traversing domains contain mostly charged amino acids
   5. A & B
8. Creutzfeldt-Jakob disease is caused by
   1. A mutated prion protein
   2. A mutated enzyme
   3. A virus
   4. A Bacterium
9. Vitamin C is an important cofactor that helps facilitate what type of post translational modification of the lysine and proline residues during the synthesis of collagen fibrils?
   1. Phosphorylation
   2. Methylation
   3. Hydroxylation
   4. Ubiquitination

Cell Structure and Function

1. During mitosis microtubules for the spindles which help guide chromosomes to the poles of the newly forming daughter cells. What are these microtubules composed of?
   1. Dimers of α and β tubulin
   2. G-actin monomers
   3. Keratin
   4. Desmin
2. When comparing the functions of Phalloidin and the Cytochalasins in stopping actin formation, which statement is correct?
   1. Phalloidin stops the addition of new g-actin subunits to F-actin
   2. Cytochallasins stops the degradation of F-actin by by binding to G-actin
   3. Phalloidin stops the degradation of the actin by binding to F-actin
   4. Cytochallasins stop the addition of new G-actin subunits to F-actin binding to it’s ends
   5. A&B
   6. C&D
3. While looking at a cancer cell under the microscope you not that the cells are continuously dividing. You are looking at a cell when the chromosomes are separating to the poles of the about to be formed daughter cells. Which structures is involved in this separation?
   1. Cytoplasmic dynein
   2. Astral microtubules
   3. Kinesin
   4. Centrosome
   5. All of the above

Blood

1. After drawing blood from a patient it is sent off to the lab. The blood is spun in a centrifuge and then the portion containing the cells is removed. Clotting factors and fibrinogen are then removed by other techniques. At the end of this separation procedure what is the portion of blood that remains?
   1. Plasma
   2. Serum
   3. Cell portion
   4. Protein portion
2. A patient comes into the emergency room complaining of fatigue after strenuous exercise and pains in his abdomen. Upon physical examination you notice there is some rigidity and tenderness in the upper left quadrant of the abdomen indicating a possible swollen spleen. Upon blood smear you notice that this patient has cells that are extremely spherical red blood cells lacking biconcave shape. Mutation in which red blood cell protein can result in this condition?
   1. Actin
   2. Spectrin
   3. Glycophorin C
   4. Myosin
3. Each of the following cells are involved in Cell-Mediated Immunity **EXCEPT**
   1. Macrophages
   2. B Lymphocytes
   3. Natural Killer Cells
   4. T Lymphocytes

Plasma Membrane

1. What is one of the main functions of the plasma membrane in all cells?
   1. Maintaining correct ionic and chemical conditions on both sides of the membrane
   2. Producing hormones
   3. Retaining cellular waste
   4. Facilitating diapadesis
2. The composition and type of lipids within each leaflet of membrane is always the same?
   1. True
   2. False
3. During an experiment you are using E. Coli to study the effects of lipid production that could be utilized for bio-fuel production. In you experiment you notice that as you very the temperature from 25 degrees Celsius to 40 degrees Celsius the E.Coli cells vary the production of their fatty acids but remain alive. Which of the following is an explanation for this finding:
   1. As the bacteria are exposed to lower temperatures in order to maintain the stability of the plasma membrane to live they produce shorter and unsaturated chain fatty acids and as they are exposed to higher temperatures that produce longer and saturated chain fatty acids.
   2. As the bacteria are exposed to higher temperatures they produce greater amounts of cholesterol
   3. As bacteria are exposed to lower temperatures the produce less amounts of cholesterol
   4. As the bacteria are exposed to lower temperatures in order to maintain the stability of the plasma membrane to live they produce longer and saturated chain fatty acids and as they are exposed to higher temperatures that produce shorter and unsaturated chain fatty acids.
4. After a meal, your glucose concentration in your blood increases. This increase in insulin causes the \_\_\_\_\_\_\_ transport of glucose into muscle and fat tissue by way of the \_\_\_\_\_ Transporter
   1. Active, GLUT4
   2. Facilitative, GLUT1
   3. Active, GLUT2
   4. Facilitative, GLUT2
5. The Nicotinic Acetylcholine receptor is an example of
   1. Voltage gated ion channel
   2. Mechanically gated ion channel
   3. Leaky Ion channel
   4. Ligand gated ion channel
6. During digestion glucose is transported into the apical end of the cell by facilitative diffusion through a transporter that requires its symport along with Na+. In order to maintain the Na+ gradient essential for glucose transport the \_\_\_\_\_ pumps Na+ out of the cell at its basal end by way of \_\_\_\_\_\_.
   1. ATP Synthase, Passive diffusion
   2. NA+/K+ ATPase, Active transport
   3. Ca+/Na+ ATPase, Active Transport
   4. K+ ATPase, Active Transport

Epithelial Tissues

1. This type of epithelium is usually seen as a single layer of rectangular cells with lots of microvili used for fluid absorption
   1. Simple Cuboidal Epithelium
   2. Stratified Squamous Epithelium
   3. Simple Columnar Epithelium
   4. Pseudostratified Columnar epithelium
2. A woman has been in and out of the IC numerous times with recurrent respiratory infections. She also has been to a fertility clinic and told she is infertile. After her last ICU visit for a respiratory infection and some tests she was informed that she has Kartagener’s/ immotile cilia syndrome. What structural abnormality is the probable explanation for her infertility and recurrent respiratory infection?
   1. Structural mutation in the actin protein
   2. Lack of centrioles within cilia
   3. Lack of dynein within cilia
   4. Mutation in a mitochondrial enzyme
3. A man is continually hospitalized with recurrent, life threatening infections along with frequent blistering. He has been diagnosed with Phemphigus Vulgaris. What protein is defective in this disease?
   1. Desmoplakin
   2. Plakoglobin
   3. Desmoglein
   4. Desmocolin

Connective Tissues

1. A biopsy of breast tissue was taken to check for cancerous cells. While looking at the stained section under the microscope there was presence of many cells that had a very small nucleus which was compressed against the plasma membrane. These cells also had a large single lipid droplet comprising most of its contents. What type of connective tissue cell is this?
   1. Adipose cell
   2. White Adipocyte
   3. Brown Adipocyte
   4. Fibroblast
2. When staining with a silver dye, the thymus gland it is noticed to be composed of numerous black fibers intersecting at almost right angles and wrapped with the processes of nearby cells. What is the main component of this cellular connective tissue fiber?
   1. Collagen Type III
   2. Collagen Type I
   3. Collagen Type IV
   4. Elastin
3. This highly coiled Glycosaminoglycan is responsible for inhibiting the migration of most bacteria while at the same time providing resistance to compression, lubrication, and small channels for nutrient movement
   1. Hyaluronic Acid
   2. Aggrecan
   3. Syndecan
   4. Fibronectin

Myoglobin and Hemoglobin

1. Fractional saturation is:
   1. Total amount of enzyme and the total amount ligand in solution
   2. Total amount of enzyme-ligand complex
   3. Percentage of enzyme-ligand complex compared to original total protein in solution
   4. The amount of ethanol in blood
2. Myoglobin and Hemoglobin are two very similar proteins both in function and structure. Which statement is correct about these similarities
   1. Both Myoglobin and Hemoglobin are primarily composed of β-sheets
   2. Myoglobin and hemoglobin help facilitate oxygen storage and transport
   3. Myoglobin and hemoglobin are both composed of α and β subunits
   4. None of the above
3. Upon analysis of the hemoglobin protein it was found that it has a Hill Coefficient of approximately 2.8. What does this indicate about hemoglobin?
   1. There is no cooperativity between the Hemoglobin subunits
   2. There is negative cooperativity between the Hemoglobin subunits
   3. There is positive cooperativity between the Hemoglobin subunits
   4. There is 2.8 binding sites for oxygen
4. In the lungs, oxygen acts by binding to hemoglobin. What effect best explains the results of this oxygen binding in the lungs?
   1. The Bohr effect of oxygen binding results in the binding of hydrogen to the hemoglobin molecule
   2. The affinity of hemoglobin for more oxygen molecules is dramatically decreased
   3. The hemoglobin molecule undergoes transition from the R to the T state
   4. The Haldane effect cause the release of CO2 from carbamylated hemoglobin
5. As someone exercises and their core body temperature increases what is the effect on the hemoglobin molecule?
   1. It denatures
   2. It increases its binding affinity for oxygen
   3. The subunits of hemoglobin dissociate from one another
   4. It decreases the binding affinity for oxygen
6. A 37 year old African American patient comes into the emergency complaining of severe pain in his extremities. The pain started when he was doing high levels of physical exercise. Upon blood smear, it was not that there was a presence of large half-moon shaped blood cells. What amino acid mutation is responsible for this half-moon shaped blood cell?
   1. Glut 🡪 Val
   2. Glut 🡪 Lys
   3. Val 🡪 Lys
   4. Ala 🡪 Arg

TCA Cycle

1. In one turn of the TCA cycle how many ATPs are generated by substrate level phosphorylation?
   1. 1
   2. 2
   3. 4
   4. 10
2. All of the following are cofactors of Pyruvate Dehydrogenase Complex and α-Ketoglutarate Dehydrogenase **EXCEPT**
   1. Lipoic acid
   2. Coenzyme A
   3. Thiamine
   4. FAD
   5. Vitamin B12
3. All these enzymes produce NADH + H+ during the TCA cycle **EXCEPT**
   1. α-Ketoglutarate Dehydrogenase
   2. Isocitrate Dehydrogenase
   3. Pyruvate Dehydrogenase Complex
   4. Succinate Dehydrogenase
   5. C & D

Cell Motility

1. A man who has frequent bleeding problems due to lack of the ability to clot has been diagnosed with Glanzmann’s Disease. What is the structural defect that results in this disorder?
   1. Mutation in β3 integrin
   2. Mutation in elastin
   3. Mutation in α1 integrin
   4. Mutation in β1 integrin
2. During extravasation trapping occurs when
   1. P-selectin binds to its receptor on the leukocyte
   2. The cells begins to roll
   3. PAF activates the PAF receptor
   4. All of the above
3. The basic steps of diapadesis include all of the following **EXCEPT**
   1. Extension of lamellapodia
   2. Migration
   3. Adhesion to focal attachment
   4. Cytoplasmic flow

Cell Cycle

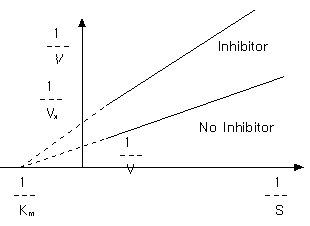
1. While looking at a microscope slide of all the stages of mitosis you notice two cells that contain their own nuclei with decondensed chromatin but whose cytoplasms are connected by a thin piece of membrane. What stage of the cell cycle are these cells in?
   1. Anaphase
   2. Telophase with Cytokinesis
   3. Interphase
   4. Prophase
2. A biopsy was taken from a cancerous tumor. Upon protein analysis which cyclin/cyclin-dependent kinase would you expect to be most likely elevated?
   1. Cdk4/6-Cyclin A
   2. Cdk5-Cyclin A
   3. Cdk4/6-Cyclin D
   4. None of the above
3. A biopsy of a cancerous tumor was obtained and protein analysis was conducted. Which protein is most likely to be mutated or lost in these cancer cells?
   1. Retinoblastoma Protein
   2. p53
   3. p16
   4. E2F

Electron Transport Chain and Oxidative Phosphorylation

1. In an experiment you culture eukaryotic cells and bath them in medium containing everything needed for glycolysis, electron transport, and oxidative phosphorylation. You then introduced Rotenone into the system. If you could look at these cells ATP production how many less ATP from one time down the electron transport chain would be produced when Rotenone was introduced?
   1. 2
   2. 3
   3. 0
   4. 1
2. In this same experiment if you removed Rotenone but then added an agent which blocked the action of NADH would these cells still continue producing ATP?
   1. Yes
   2. No
3. The reduction potential of two redox couples are E = -0.32 V and E= -0.18 V. What is the electrical potential of the reaction?
   1. E= 0.13 V
   2. E = -0.50 V
   3. E = -0.14 V
   4. E = 0.50 V
4. ATP is generated by
   1. The chemiosmotic potential generated from a proton gradient
   2. The reduction of Oxygen
   3. Phosphorylation of ADP by ATP Synthase
   4. A & C
5. New born babies can generate heat without producing more energy in the form of ATP by
   1. Uncoupling the proton gradient generated from the ETC from ATP Synthase
   2. Utilizing the uncouple protein Thermogenin
   3. Having Brown fat
   4. All of the above
6. How many ATP is generated from one turn of the TCA Cycle via electron transport and oxidative phosphorylation?
   1. 4
   2. 6
   3. 9
   4. 12

Enzymes

1. Isocitrate Dehydrogenase is involved in the production of a high energy intermediate in the TCA cycle in the form of NADH. NADN is produced by this enzyme by oxidizing Isocitrate to α-ketoglutarate. This an example of which type of enzyme?
   1. Lyase
   2. Hydrolase
   3. Oxidoreductase
   4. Transferase
   5. Ligase
2. Which of the following best describes an enzyme
   1. It is a catalyst that lowers the activation energy to make reaction proceed faster
   2. It is a catalyst that changes the equilibrium to make more products in a reaction
   3. It is a catalyst that makes a reaction more favorable by making the Gibbs Free Energy of reaction more negative than if it were uncatalyzed
   4. It is a catalyst that typically compresses a reaction into one steps to make it proceed quicker
3. Each of the following are ways that enzyme catalyze reactions **EXCEPT**
   1. Covalent Catalysis
   2. Acid/Base Catalysis
   3. Proximity Catalysis
   4. Bond Distortion Catalysis
   5. None of the Above
4. Based on the graph below what type of inhibitor is acting on this enzyme?



* 1. Competitive
  2. Noncompetitive
  3. Irreversible
  4. Suicide

56. What type of inhibition can be reversed by increasing the substrate concentration?

a. Noncompetitive Inhibitor

b. Competitive Inhibitor

c. Irreversible Inhibitor

d. Suicide Inhibitor